ADVANCES IN DEVELOPMENT OF Ag-CLAD Bi-BASED SUPERCONDUCTING TAPES

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Significant advances in development of the Ag-clad Bi-based superconducting tapes have been recently achieved by the Wollongong group. These include understanding of the effect of initial phase composition on sintering temperature, formation mechanism of high T_c phase, control of sausaging formation during rolling and effect of atmosphere on microstructure of the tapes. Techniques such as "sandwich rolling" process have been developed to prevent the formation of sausaging and cracks in longitudinal direction of the Ag-clad Bi-based superconducting tapes. High J_c for Ag/Bi-2212 tapes achieved through MTG in the alternating oxygen and nitrogen atmosphere. While N_2 annealing on cooling ensures high T_c, O_2 treatment during melting period enhances the stability of 2212, allowing for grain growth with ample liquid formation. Direct observation of the interface achieved by removing Ag sheath with Hg alloy shows highly dense, textured and thin-film like structure. Ca_2PbO_4 was found to have significant effect of sintering temperature. Incorporation of Ca_2PbO_4 into 2212 phase can reduce the duration of 2223 tape process to below 100h, resulting high J_c with a record performance in magnetic field. 23.4% of zero field J_c value was retained in 1T. Grain growth in 2223 tape must be well controlled in order to optimise J_c. Features of 2212 tape and 2223 tape are compared in terms of their processing, microstructure and electromagnetic properties. Potential strong links in the tape are proposed to be the low angle tilt boundaries where the Cu-O planes are well connected. The pinning potential, U_o, for 2223 tape, determined by using magnetoresistance measurements, is larger than that for the best 2212 tape and epitaxial thin films while U_o for the latter is, in turn, higher than 2212 single crystal. This may be attributed to the difference in dislocation density in these materials.